Name: ________ Date: ________

Polynomial Operations SOLUTIONS (version 21)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -3x^5 + 9x^4 + 2x^3 + 5x + 10$$

$$q(x) = 6x^5 + 3x^3 + 4x^2 - 5x - 9$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$p(x) = (-3)x^5 + (9)x^4 + (2)x^3 + (0)x^2 + (5)x^1 + (10)x^0$$
$$q(x) = (6)x^5 + (0)x^4 + (3)x^3 + (4)x^2 + (-5)x^1 + (-9)x^0$$
$$p(x) - q(x) = (-9)x^5 + (9)x^4 + (-1)x^3 + (-4)x^2 + (10)x^1 + (19)x^0$$
$$p(x) - q(x) = -9x^5 + 9x^4 - x^3 - 4x^2 + 10x + 19$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 9x^2 + 8x + 3$$

$$b(x) = -4x + 3$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$9x^2$	$8x$	3
$-4x$	$-36x^3$	$-32x^2$	$-12x$
3	$27x^2$	$24x$	9

$$a(x) \cdot b(x) = -36x^3 - 32x^2 + 27x^2 - 12x + 24x + 9$$

Combine like terms.

$$a(x) \cdot b(x) = -36x^3 - 5x^2 + 12x + 9$$

3. Express $(x + 1)^4$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^4 + 4x^3 + 6x^2 + 4x + 1$$

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4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 2x^3 - 18x^2 + 16x - 10 \\ g(x) &= x - 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

	2	-18	16	-10
8		16	-16	0
	2	-2	0	-10

So,

$$\frac{f(x)}{g(x)} = 2x^2 - 2x + \frac{-10}{x-8}$$

In other words, $h(x) = 2x^2 - 2x$ and the remainder is $R = -10$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 2x^3 - 18x^2 + 16x - 10$. Evaluate $f(8)$.

You could do this the hard way.

$$\begin{aligned} f(8) &= (2)\cdot(8)^3 \ + \ (-18)\cdot(8)^2 \ + \ (16)\cdot(8) \ + \ (-10) \\ &= (2)\cdot(512) \ + \ (-18)\cdot(64) \ + \ (16)\cdot(8) \ + \ (-10) \\ &= (1024) \ + \ (-1152) \ + \ (128) \ + \ (-10) \\ &= -10 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(8)$ equals the remainder when $f(x)$ is divided by $x - 8$. Thus, $f(8) = -10$.